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AN ANNOTATED CHECKLIST OF THE SPECIES OF THE PARNASSIINAE (LEPIDOPTERA: PAPILIONIDAE)

Häuser, C. L., 1993. An annotated checklist of the species of the Parnassiinae (Lepidoptera: Papilionidae). – Tijdschrift voor Entomologie 136: 137-146. [ISSN 0040-7496]. Published 10 December 1993.

A total of 76 binominal taxa including 22 cases of questionable species status are listed for the Parnassiinae, a subfamily comprising eight genera of predominately palaeartic swallowtail butterflies. The taxonomic history of all doubtful species is briefly reviewed and possible affinites of these taxa are indicated. The majority of taxa contributing to a considerable increase in species number compared to previous accounts represent changes in status rather than genuine discoveries of new taxa. This is seen in relation to a change of attitude in taxonomic practise.

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Key words. - Papilionidae, Parnasiinnae, checklist, species number.

The Parnassiinae represent one of the three currently recognized subfamilies of the Papilionidae, the 'Swallowtail Butterflies'. Among the swallowtails, the 'Apollo Butterflies' in particular have for long been highly sought after by butterfly collectors because of their great aesthetic appeal and considerable intraspecific variation in wing pattern. This specialized interest has led in the past to voluminous works devoted to catalog and illustrate all the many named species-group taxa and infraspecific forms of the Parnassiinae (e.g., Austaut 1889, Verity 1905-1911, Stichel 1907a, 1907b, Rothschild 1918a, 1918b, Bryk 1934, 1935, Eisner 1974, 1976). In contrast, comparatively little attention has hitherto been paid to species-level taxonomy, and to morphological or ecological peculiarities of the group.

The subfamily is largely restricted to the palaearctic region with three species occuring in western North America, and completely absent from tropical zones (Stichel 1907a, 1907b, Reinig 1937, Ackery 1975). In an evolutionary view, the Parnassiinae have always been regarded as a basic stock of the Papilionidae from which all other higher taxa of the family arose (e.g., Spuler 1892, Reuter 1897, Ford 1944, Munroe 1961). In phylogenetic terms, the Parnassiinae are considered accordingly as the sistergroup of the Papilioninae, which comprise all remaining swallowtails, with the exception of one monotypic genus (Hancock 1983, Miller 1987, Häuser 1993).

Since the last comprehensive review of the Parnassiinae by Ackery (1975) several species have been described as new, mostly in the genus *Parnassius* (e.g., Koiwaya 1987, Korshunov 1988, Weiss & Michel 1989, Watanabe 1990). Furthermore, a number of formerly recognized species has been shown to consist of two or more closely related, but reproductively well isolated species, often on the basis of accumulated knowledge on their early stages and biology (e.g., Larsen 1973, de Freina 1985, Kreuzberg 1985). It seems therefore appropriate to provide an updated species checklist for this group. This list is also meant as a preliminary basis for a much needed phylogenetic analysis of the Parnassiinae at the species level, with the intention to point out all cases of presently problematic species delimitations.

CHECKLIST

The present list can only be regarded as a first step towards a complete revision of the Parnassiinae even at species level. For this list, a 'splitter' approach was followed in many cases, in that geographically well separated and morphologically distinct taxa are rather given species status than treated as conspecific with their geographic vicariants. None of the many available infraspecific names appear in this list, but a number of former subspecies have been elevated here to species rank following suggestions elsewhere in the literature. Similarly, all recently described species in the genus *Parnassius* are retained here in binominal combination. However, all closely related, but strictly allopatric species-group taxa are indicated in the present list by indentation and omitting the generic name. Under a more rigorous application of the biological species concept, most of these cases might well turn out as conspecific, and could be treated as such for purely classificatory purposes.

The Parnassiinae are seen here to comprise the eight genera listed below following recent classifications of the Papilionidae (Munroe 1961, Ackery 1975, Hancock 1983, Miller 1987), despite the fact that the subfamily as currently defined might not represent a monophyletic group in phylogenetic terms (Hiura 1980, Häuser 1990, 1993). All taxa are listed fully with author and year, and their sequence follows current ideas about taxonomic and phylogenetic relationships. Comments on individual taxa are presented as a series of notes, which are numbered consecutively and appear at the end of the checklist.

Subfamily Parnassiinae Swainson, 1840

Genus: *Hypermnestra* Ménétriés, 1848	01
Hypermnestra helios (Nickerl, 1846)	
Genus: *Parnassius* Latreille, 1804	02
Subgenus: *Parnassius* Latreille, 1804	03
Parnassius apollo (Linnaeus, 1758)	
P. nomion Fischer De Waldheim, 1823	
P. phoebus (Fabricius, 1793)	
sacerdos Stichel, 1906	04
ruckbeili Deckert, 1909	05
P. actius (Eversmann, 1843)	
P. jacquemontii Boisduval, 1836	
P. tianschanicus Oberthür, 1879	
P. epaphus Oberthür, 1879	
P. bremeri Bremer, 1864	
P. honrathi Staudinger, 1882	
P. apollonius (Eversmann, 1847)	
Subgenus: *Driopa* Korshunov, 1988	06
P. mnemosyne (Linnaeus, 1759)	
P. stubbendorfii Ménétriés, 1849	
hoenei Schweitzer, 1912	07
P. glacialis Butler, 1866	
P. eversmanni Ménétriés, 1855	
felderi Bremer, 1861	08
P. ariadne (Eversmann, 1843)	09
nordmanni [Ménétriés] in Siemaschko, 1850	09, 10
clodius Ménétriés, 1855	09
P. orleans Oberthür, 1890	
Subgenus: *Tadumia* Moore, 1902	11
P. hardwickii Gray, 1831	
P. hunnyngtoni Avinoff, 1916	12
P. acco Gray, 1853	
przewalskii Alpheraky, 1887	13
baileyi South, 1913	14
P. szechenyii Frivaldszky, 1886	
P. cephalus Grum-Grshimailo, 1891	
pythia Roth, 1932	15
P. maharaja Avinoff, 1916	16
labeyriei Weiss & Michel, 1989	17
nosei Watanabe, 1990	18
P. schultei Weiss & Michel, 1989	19
Subgenus: *Koramius* Moore, 1902	20
P. delphius (Eversmann, 1843)	
maximinus Staudinger, 1891	21
P. cardinal Grum-Grshimailo, 1887	22
P. staudingeri Bang-Haas, 1882	23
stenosemus Honrath, 1890	24
P. stoliczkanus Felder & Felder, 1865	25
nandadevinensis Weiss, 1990	26
P. patricius Niepelt, 1911	27
priamus Bryk, 1913	28
hide Koiwaya, 1987	29
P. acdestis Grum-Grshimailo, 1891	
Subgenus: *Sachaia* Korshunov, 1988	30
P. tenedius Eversmann, 1851	
P. arcticus (Eisner, 1968)	31
ammosovi (Korshunov, 1988)	32
P. simo Gray, 1853	
andreji Eisner, 1930	33
simonius Staudinger, 1889	34
P. boedromius Püngeler, 1901	35
Subgenus: *Kailasius* Moore, 1902	36
P. charltonius Gray, 1853	
P. loxias Püngeler, 1901	37
autocrator Avinov, 1913	38
P. imperator Oberthür, 1883	
P. inopinatus Kotzsch, 1940	
Genus: *Archon* Hübner, [1822]	
Archon apollinus (Herbst, 1798)	
A. apollinaris (Staudinger, 1892)	39
Genus: *Zerynthia* Ochsenheimer, 1816	40
Zerynthia rumina (Linnaeus, 1758)	
Z. polyxena ([Denis & Schiffermüller], 1775)	
Genus: *Allancastria* Bryk, 1934	41
Allancastria cerisy (Godart, [1824])	42
cretica (Rebel, 1904)	43
louristana (Le Cerf, 1908)	44

A. deyrollei (Oberthür, 1869)	45
A. caucasica (Lederer, 1864)	46
Genus: *Sericinus* Westwood, 1851	
Sericinus montela Gray, 1853	
Genus: *Bhutanitis* Atkinson, 1873	47
Bhutanitis mansfieldi (Riley, 1939)	48
B. thaidina (Blanchard, 1871)	
B. lidderdalii Atkinson, 1873	
B. ludlowi Gabriel, 1942	
Genus: *Luehdorfia* Crüger, 1878	
Luehdorfia puziloi (Erschoff, 1872)	
L. japonica Leech, 1889	
L. chinensis Leech, 1893	49
L. longicaudata Lee, 1982	50

NOTES

01. – The genus *Hypermnestra* has long been included in the subfamily (Spuler 1892, Stichel 1907a, Bryk 1935, Ackery 1975), but recent phylogenetic investigations suggest that it might not form part of the Parnassiinae as a monophyletic group (Hiura 1980, Häuser 1993).

02. – The splitting of the genus *Parnassius* into several genera had started by Moore (1901-1903), and was further elaborated by Bryk (1935), and, most recently, by Korshunov (1988, 1990). This is not regarded here as useful taxonomic practice (Sokolov 1929, Munroe 1961, Ackery 1975), particularly as long as the genus is assumed to be monophyletic. Some of the generic names proposed, however, are retained here to designate presumably monophyletic species-groups, which for taxonomic purposes can be treated as subgenera (Munroe 1961; see notes 03, 06, 11, 20, 30, 36).

03. – The subgenus *Parnassius* or the so-called 'apollo-group' comprises a morphologically and ecologically homogeneous group of species with larval hostplants restricted to Crassulaceae and Saxifragaceae (Bryk 1935, Ackery 1975, Kreuzberg 1987a). The proper allocation of many taxa from Central Asia, where several species of the group coexist, is still problematic and awaits further detailed studies. For the present list, with the exceptions noted below, the arrangement of species by Ackery (1975) is followed.

04. – The separation of the European taxa as a species distinct from *P. phoebus* is largely based on peculiar ecological requirements and morphological differences of the larvae, in addition to considerable geographic separation. *P. sacerdos* is restricted to habitats along and near small streams of running water at elevations between 1500 and 2600 m in the European Alps, and its larvae exclusively feed on *Saxifraga aizoides* (Weidemann 1986, Descimon et al. 1989, Schweizerischer Bund für Naturschutz 1991). In contrast, habitat preferences are quite variable in *P. phoebus* in Northern Asia and Western North America where the species can occur from near sea level in Eastern Siberia and steppe zone habitats in the Altai Mountains (Kurentzov 1970, Mrácek 1989) up to the nival zone above the tree line in the Rocky Mountains (Ferris 1976). In North America, larval hostplants of *P. phoebus* are various species of *Sedum*, whereas local species of *Saxifraga*, as well as *S. aizoides* are not accepted by larvae in captivity (Scott 1986: 189, Nardelli 1991).

05. – *P. ruckbeili* had been originally described as a subspecies of *P. phoebus*, and was treated subsequently as such by most authors (Rothschild 1918b, Bryk 1935, Eisner 1976). The taxon, however, shows also affinities both in external appearence and male genitalia to *P. actius* (Bryk & Eisner 1935, Hering 1935), and Eisner (1961: 180) finally placed it as a separate species. The known geographic range of *P. ruckbeili* is restricted to mountains North-East of the Tarim basin completely separated from both *P. phoebus*, and *P. actius*, which leaves the species status doubtful. The name is often spelt as '*rückbeili*' or '*rueckbeili*' (e.g., Bryk 1935, Hering 1935, Eisner 1976), both of which represent unjustified emendations.

06. – The '*mnemosyne*-group' was in the older literature often referred to by the (sub-)generic name *Doritis* Fabricius, 1807 (Moore 1901-1903, Sokolov 1929, Bryk 1935, Munroe 1961), which, however, has *P. apollo* as its type-species, and thereby is invalid as an objective synonym of *Parnassius* Latreille, 1804 (Hemming 1967). The name *Adoritis* Koçak, 1989 is invalid as an objective synonym of *Driopa* Korshunov, 1988.

07. – *P. hoenei* from the Japanese Island of Hokkaido had originally been described as a subspecies of *P. stubbendorfii* and was subsequently treated as such by most authors (Bryk 1935, Eisner 1974, Ackery 1975). Recently, the taxon has been elevated to species rank by several Japanese authors (Fukuda et al. 1982, Kitahara 1990), but the conclusive evidence in support of such a view is not clear.

08. – *P. felderi* had been described as species and was accepted as such by most early authors (Stichel 1907a, Verity 1905-1911, Rothschild 1918b; but see Elwes 1886). Later on, the taxon was generally placed as a subspecies of *P. eversmanni* (Bryk 1922, Bang-Haas 1927, Eisner 1961, 1974, Kurentzov 1970, Ackery 1975), but some doubts about its proper status remained (e.g., Bang-Haas 1927: 8, Eisner 1974: 90). The allopatric distribution of *P. felderi* and typi-

cal forms of *P. eversmanni* (see Iwamoto & Inomata 1988), and the occurrence of apparent intermediate taxa (Bryk 1935, Eisner 1961), give little support to maintain it as a distinct species.

09. – *P. ariadne*, *P. nordmanni*, and *P. clodius* have always been treated as distinct species despite their close morphological and ecological similarity, and their strictly allopatric distribution (Elwes 1886, Stichel 1907a, Bryk 1935, Eisner 1974, Ackery 1975). This practice is followed here, but it should be pointed out that the degree of morphological difference between these taxa, for example, in male and female genitalia (Hering 1932, Orr 1988), especially, between *P. nordmanni* and *P. clodius* is not very large. For consistency, then, comparable cases of geographically vicariant taxa should also be classified as different species (e.g. 04).

10. – The author of *P. nordmanni* is sometimes been given as 'Nordmann 1851' (Ackery 1975, Hancock 1983), based on conclusions by Hemming (1934) that a description of the taxon by Ménétriés was never published. However, according to bibliographic studies by Nekrutenko & Kerzhner (1986) the original description of *P. nordmanni* by Ménétriés was indeed published in 1850 and thus takes precedence.

11. – In the subgenus *Tadumia*, the so-called '*acco*-group', Stichel (1907a), Bryk (1935), and Eisner (1976), had included *P. acco*, *P. simo*, *P. tenedius*, and related forms, but not *P. szechenyii*, *P. cephalus*, *P. maharaja*, and *P. hardwickii*, which were placed in different (sub-)genera. The separation of the *simo*- and *tenedius*- groups from *Tadumia* on morphological grounds (Munroe 1961, Ackery 1975) is further supported by biological characters (Kreuzberg 1985, 1987a). A close relationship between *P. acco*, *P. szechenyii*, *P. hardwickii*, and *P. cephalus* with all associated taxa is supported by similarity in male genitalia, sphragis structure, and larval hostplants (Hering 1932, Kreuzberg 1987a, Weiss & Michel 1989).

12. – *P. hunnyngtoni* had originally been described as a separate species on the basis of its extremely small size and different wing pattern (Avinoff 1916), but it was subsequently treated as conspecific with *P. acco* by Bang-Haas (1927), Eisner (1976), and Ackery (1975). In contrast to all other *Parnassius*, this species flies at high altitudes in early spring (Riley 1927, W.Eckweiler, pers. com.). Furthermore, its sympatric occurrence with *P. acco* (Riley 1927, Weiss & Michel 1989) leaves little doubt as to place it as a separate species. The species name is often found spelt as '*hannyngtoni*' or '*hanningtoni*' (Bryk 1935, Eisner 1976, Weiss 1992), both of which are unjustified emendations.

13. – *P. przewalskii* had been described as a separate species and was treated as such by Stichel (1907a), Verity (1905-1911), Bryk (1935), and Munroe (1961), whereas it was considered as conspecific with *P. acco* by Hering (1937), Ackery (1975), Eisner (1976), Hancock (1983), and Weiss (1992). Recent discoveries have extended the known range of *P. przewalskii* considerably (Huang & Murayama 1991, Schulte 1992), which now covers most of North-Western Tibet and Qinghai. Some of the new taxa described appear intermediate in wing pattern with *P. acco*, and leave further doubts about the species status of *P. przewalskii* (Weiss 1992).

14. – *P. baileyi* is another questionable species geographically separated but close to *P. acco*, which had originally been described as a subspecies of *P. acco* from South-Eastern Tibet. Subsequently Bryk (1932a) described *P. rothschildianus* as a species separate from *P. acco* from Western Sichuan, which he later united with *baileyi* and another new taxon (Bryk 1932b). All these taxa were later on placed by Bryk (1935) as subspecies of *P. przewalskii*, whereas Bang-Haas (1927), Eisner (1976), and Ackery (1975) considered them all conspecific with *P. acco*. New reports of 'typical' *P. acco* occurring in South-East Tibet (Nosé 1990), in addition to reported constant differences in genitalia (Weiss 1992) suggest that possibly two species might occur in that region, and give reason to tentatively maintain *P. baileyi* as a species. However, a thorough taxonomic revision of the entire *acco*-group is certainly needed and should yield a more definite conclusion.

15. – The description of *P. pythia* is based on a single small female specimen from South-Western Tibet. The taxon was placed as a subspecies of *P. cephalus* by Bryk (1935), but it was maintained as a separate species in a list by Munroe (1961). The type locality of *P. pythia* was at the time of its discovery well separated from the then known range of *P. cephalus*, but geographically intermediate populations have since been found, which all appear conspecific with *P. cephalus* (Weiss 1992).

16. – Originally, *P. maharaja* had been described as a separate species (Avinoff 1916), but it was placed as a subspecies of *P. cephalus* by Bryk (1922), Eisner (1958, 1976), and Ackery (1975) despite constant differences in wing venation and genitalia between the two taxa (Hering 1932, Bryk 1935). The sympatric occurrence of newly discovered taxa closely related to *P. maharaja* with *P. cephalus* in Southern and South-Eastern Tibet (see below, 17 + 18) give further support to maintain *P. maharaja* as a separate species from *P. cephalus* (Bryk 1935, Munroe 1961, Weiss 1992).

17. – The recently discovered *P. labeyriei* from Southern Tibet is morphologically very similar to *P. maharaja* from Ladakh (see Michel & Weiss 1989, Watanabe 1990), and probably just represents a geo-

graphic vicariant form of the latter. However, possibly intermediate records are currently missing from Western Tibet, which certainly is one of the areas that have never been adequately surveyed. Additional new discoveries indicate that this species is more widely distributed in Western China (Weiss 1991); see below, 18.

18. – *P. nosei* from E. Tibet is also very similar to *P. maharaja*, and has already been regarded as conspecific with *P. labeyriei* (Weiss 1991). However, both *P. labeyriei* and *P. nosei* reportedly occur next to each other in South-Eastern Tibet (Nosé 1990), which is the reason to retain the latter provisionally here as a distinct species. Probably at least one of the two taxa will turn out to be conspecific with *P. maharaja.*

19. – *P. schultei* has been described from only three worn specimens from Southern Tibet (Weiss & Michel 1989). The genitalia of the male holotype appear to differ considerably from *P. cephalus*, and also from *P. maharaja* and *P. labeyriei*, which gives reason to place it here as a distinct species.

20. – The status of most of the following species listed under the subgenus *Koramius* is still problematic, and a comprehensive revision of the entire '*delphius*-group' is much needed. Previous authors have generally recognized only a single (Stichel 1907a, Verity 1905-1911, Hering 1932), two (Elwes 1886, Bang-Haas 1915, Rothschild 1918b), three (Bang-Haas 1927, Ackery 1975, Hancock 1983), four (Bryk 1935, Collins & Morris 1985), or at most five different species (Munroe 1961). However, detailed comparative investigations on the ecology and genital morphology (Kreuzberg 1985) indicate that in several mountain ranges of Central Asia (Tian-Shan, Alai, Pamirs) two to four distinct species of the '*delphius*-group' coexist. The species recognized by Kreuzberg (1985, 1987a) are accepted for the present list (Weiss 1992), but it should be noted that an exact delimitation of these species and a proper allocation of the more than 50 taxa named formerly lumped under *P. delphius* still awaits to be accomplished.

21. – *P. maximinus* was recognized as a distinct species from *P. delphius* by Kreuzberg (1985) on the basis of different ecological requirements and differences in larval colouration. The species seems restricted to the Western Tian-Shan range and shows no significant overlap in its range with *P. delphius* (Weiss 1992), which leaves some doubt about its status as a separate species.

22. – *P. cardinal* had originally been described as a subspecies of *P. delphius*, and was first recognized as a separate species by Stsherkin (1979) based on its sympatric occurrence with another *delphius*-group taxon. Subsequent studies by Kreuzberg (1985) confirmed the coexistence of *P. cardinal* and *P. staudingeri* in Tadzhikistan, where *P. cardinal* occurs mainly at elevations between 3000 and 3200 m.

23. – *P. staudingeri* was reinstated as a different species from *P. delphius* by Kreuzberg (1985) on the basis of differences in male and female genitalia as well as wing pattern, in addition to ecological differences regarding habitat and larval hostplants. The species appears to co-exist in parts of its range with *P. cardinal*, but is strictly allopatric with *P. delphius* and *P. stenosemus* (Weiss 1992).

24. – *P. stenosemus* had been described as a subspecies of *P. delphius* and it was treated as such or as a subspecies of *P. stoliczkanus* by Stichel (1907a), Verity (1905-1911), Rothschild (1918b), Bang-Haas (1927), Eisner (1959a, 1976), and Ackery (1975). The taxon was first given species status by Moore (1901-1903), followed by Bryk (1935), Munroe (1961), and Weiss (1992), on the basis of constant differences in wing pattern and male genitalia with the sympatrically occurring *P. stoliczkanus.* However, the known range of *P. stenosemus* shows no overlap with *P. staudingeri*, and further studies are needed to confirm its species status.

25. – *P. stoliczkanus* had been described as a separate species, but was later considered a subspecies of *P. delphius* by Stichel (1907a), Verity (1905-1911), Avinov (1913), Rothschild (1918b), Eisner (1959a, 1976) and Ackery (1975). It occurs sympatrically with *P. stenosemus*, and had been already given species status by Elwes (1886), Bang-Haas (1927), Bryk (1935), Munroe (1961), and Collins & Morris (1985).

26. – The original description of *P. nandadevinensis* is based on a single worn male specimen from Northern Uttar Pradesh, India. According to illustrations of the holotype and parts of its genitalia, it appears intermediate between *P. acdestis* and *P. stoliczkanus*, and could possibly represent an aberrant specimen of the latter species.

27. – Since its original description *P. patricius* had generally been accepted as a species separate from *P. delphius* (Bryk 1935, Munroe 1961, Ackery 1975, Hancock 1983, Weiss 1992; but see: Bang-Haas 1915), and recent morphological and ecological studies further support this view (Kreuzberg 1985).

28. – *P. priamus* had been originally described as a subspecies of *P. acdestis*, and subsequently the taxon was considered as either belonging to this species or to *P. delphius* (Bang-Haas 1915, Bang-Haas 1927). Marked differences in the shape of the sphragis between *P. priamus* and *P. acdestis* led Bryk (1932b, 1935) to separate it from the latter species and to place it as a subspecies of *P. patricius.* Apparent differences in male genitalia between *P. priamus* and *P. patricius* could support the view of two different species (Weiss & Michel 1989), but both taxa occur allopatrically (Weiss 1992).

29. – *P. hide* has been described recently from the Kunlun range, and was subsequently also found in Western Sichuan and South-Eastern Tibet (Koiwaya 1987, Nosé 1990, Shinkai 1990). The taxon appears not to differ much in male genitalia from *P. priamus* from Southern Tibet, and probably is conspecific with the latter or with *P. patricius* (see Weiss & Michel 1989: 12).

30. – The type species of Sachaia is *P. tenedius* by original designation (Korshunov 1988), and *Kreizbergius* Korshunov, 1990 is available as a separate generic name for *P. simo* and related taxa in this group.

31. – Originally, *P. arcticus* had been described as a northern subspecies of *P. simo*, a species which does not occur in Siberia, but Eisner (1969) later himself corrected this misjudgement, and placed the taxon as a subspecies of *P. tenedius* (Eisner 1976). In 1984, however, another *Parnassius* species was discovered in Central Siberia that on ecological and morphological grounds is clearly separate from *P. tenedius*; without much consideration, this species has been repeatedly referred to as *P. arcticus* (Mrácek 1989, Weiss 1991), but proper identification must still await critical examination of the holotype (see below, 32).

32. – As judged from the original description (Korshunov 1988), *P. ammosovi* appears not to be conspecific with *P. tenedius*, and probably represents the second Siberian species of that group (see above, 31); this taxon, however, would then be a junior synonym of *P. arcticus* depending on the identity of the holotype of the latter.

33. – *P. andreji* has been separated recently together with another six subordinate taxa from *P. simo* by Weiss (1991), based on differences in wing pattern and male genitalia; both character sets, however, have not yet been adequately documented. The fact that *P. andreji* is not found sympatrically with *P. simo*, which occurs over most of Tibet into South-West China, makes this separation furthermore questionable.

34. – *P. simonius* had been described as a subspecies of *P. simo* and was treated as such by most authors (Bryk 1935, Munroe 1961, Ackery 1975). However, Avinov (1913) already had remarked on constant differences in male genitalia between *P. simonius* and *P. simo* (see also, Hering 1932), but did not separate both taxa at the species level. In a comparative study on the group, Kreuzberg (1985) elevated the taxon to species rank supported by constant differences in postabdominal morphology. As far as known, however, *P. simonius* and *P. simo* occur allopatrically and the ranges of the two taxa show no overlap (Weiss 1991).

35. – *P. boedromius* had originally been described as a separate species, but was since generally regarded as a subspecies of *P. simo* (Stichel 1907a, Bryk 1935, Ackery 1975), except for Avinov (1913) followed by Rothschild (1918b), who had recognized that it occurs sympatrically with typical forms of *P. simo*. Recent studies by Kreuzberg (1985) supported Avinov's early conclusions through the confirmation of sympatric occurrences of the two species, and ecological and morphological differences.

36. – The type species of *Kailasius* is *P. charltonius* by original designation, and a separate generic name, *Eukoramius* Bryk, 1935, is available for *P. imperator* (Hemming 1967).

37. – *P. loxias* had been described as a species and has since been treated as such by most authors (Verity 1905-1911, Bryk 1935, Eisner 1959b, Munroe 1961, Ackery 1975, Kreuzberg 1985), except for Bang-Haas (1927) who regarded it as a subspecies of *P. charltonius*. The recent discovery of its biology confirms its status as a separate species from *P. charltonius* (Kreuzberg & Pljushch 1989).

38. – *P. autocrator* was originally described as a subspecies of *P. charltonius* (Avinov 1913, Bryk 1935), but because of its unique wing pattern was later on universally accepted as a separate species (Bang-Haas 1927, Eisner 1959b, Ackery 1975). In terms of genitalia and ecology, however, it shows a close affinity to *P. loxias* (Bryk 1937, Kreuzberg 1987b), from which it is geographically well separated (Weiss 1991).

39. – *A. apollinaris* had always been regarded as a subspecies of *A. apollinus* (Stichel 1907a, Bryk 1934, Igarashi 1979), until de Freina (1985) proposed the existence of two distinct but allopatric *Archon* species based on differences in genitalia and larval colouration. The recent discovery of areas of sympatry of two distinct taxa in the province of Mardin in Southern Turkey further supports this view (Carbonell 1991).

40. – The generic name frequently used for *Zerynthia* in the older literature is *Thais* Fabricius, 1807, which is invalid as a junior primary homonym (Hemming 1967). The older replacement name *Parnalius* Rafinesque, 1815 has been suppressed for the principle of priority by the Plenary Powers of the International Commission on Zoological Nomenclature (Opinion 1134).

41. – The genus *Allancastria* has been synonymized by some authors with *Zerynthia* (Ackery 1975, Igarashi 1979, Olivier 1991), but it is retained here as a separate genus on the basis of considerable differences in genitalic structures (see: Bryk 1934, Nekrutenko 1990).

42. – The species name has often been incorrectly cited as '*cerisyi* Godart, 1822' (e.g., Rothschild 1918a, Bryk 1934, Bernardi 1970, Eisner 1974) based on a reference that was never published (see Cowan 1970: 17). *A. cerisy* was long regarded as the only species in the genus (Stichel 1907b, Bryk 1934, Munroe 1961, Eisner 1974, Ackery 1975, Igarashi

1979), and the discovery of two sympatric *Allancastria* species in Lebanon (Larsen 1973, 1975) has finally led to the separation of several other species (see below, 43-46). A complete revision of all *Allancastria* taxa appears, therefore, much needed (Olivier 1991).

43. – The elevation of *A. cretica* endemic to the isle of Crete as a different species from *A. cerisy* was first proposed by Koçak (1981), and is presumably based on differences in wing shape and colouration only. As a number of phenotypically different populations of *A. cerisy* from other Eastern Mediterranean islands have also been named as subspecies (see Bryk 1934, Olivier 1991), the single treatment of this taxon as a species (e.g., Kudrna 1986: 169) must appear questionable, and cannot be justified by a few distinguishing features and geographic separation alone.

44. – *A. louristana* had been described as a subspecies of *A. cerisy*, and it was first treated as a separate species by Kuhna (1977), followed by Blom & Eisner (1979), de Freina (1979), and Collins & Morris (1985). The distinguishing characters supporting such a view, however, have not been clearly stated. Areas of sympatry between *A. louristana* and either *A. cerisy* or *A. deyrollei* are presently not known, and the status of this taxon therefore remains questionable.

45. – Although *A. deyrollei* had originally been given species rank when first described, it was recognized only recently as a separate species from *A. cerisy* based on differences in wing pattern, genital morphology and early stages (Bernardi 1970, Larsen 1973, 1975). The species occurs partly sympatrically with *A. cerisy* in Southern Turkey and Lebanon (Kuhna 1977, de Freina 1979, 1986).

46. – *A. caucasica* had been described as a subspecies of *A. cerisy*, and it was first regarded as a different species by Kuhna (1977) based on characters of wing pattern, colouration and genitalia. This view has since been largely accepted (de Freina 1979, Collins & Morris 1985, Nekrutenko 1990), but the exact delimitation of the species and the allocation of various subspecific taxa to *A. cerisy* and *A. caucasica*, respectively, is not clear.

47. – At present, the genus *Bhutanitis* is held to comprise the four species listed here (Ackery 1975, Collins & Morris 1985). Recent field studies in South-West China, however, seem to indicate that, at least, three different *Bhutanitis* species exist in that area (Hou 1992). As so far only two species were known to occur in the region (Bryk 1934, Ackery 1975), the existence of an additional species in this genus is quite likely. Although several new taxa were named in Hou's abstract (1992), these names cannot be accepted as available. In the older literature, the genus is often referred to by the name *Armandia* Blanchard, 1871, which is invalid as junior homonym (Hemming 1967).

48. – A separate genus, *Yunnanopapilio* Hiura, 1980, has been proposed for *B. mansfieldi*, but a generic separation of this species from *Bhutanitis* seems not justified (Saigusa & Lee 1982), particularly when considering its biology and early stages (Lee 1986a, 1986b).

49. – *L. chinensis* had been described as a subspecies of *L. japonica*, and was treated as such by most authors (Verity 1905, Rothschild 1918a, Ackery 1975), except for Bryk (1934), and later on Eisner (1974) who placed it as a subspecies of *L. puziloi*. The taxon was first recognized as a species by Lee (1978) based on marked differences in the early stages, a view which has now become widely accepted (Collins & Morris 1985, Nosé 1990).

50. – *L. longicaudata* was recently discovered in Western China, and occurs partly sympatrically with *L. chinensis*. The differences seen in adult morphology and early stages seem to furthermore justify its status as a separate species (Nosé 1990).

CONCLUSIONS

In the present list, 76 species taxa are included in the subfamily Parnassiinae. Although 22 of these binominal taxa are indicated as questionable species some of which will eventually have to be synonymized, the remaining number of recognized species will still exceed the fourty to fifty species listed in most previous taxonomic reviews of the subfamily. Generally, species numbers for the eight genera included here in the Parnassiinae range from 39 species recognized by Stichel (1907a, 1907b) at the turn of the century, to 42 (Eisner 1974, 1976), 44 (Bryk 1934, 1935, Ackery 1975), 48 (Hancock, 1983), 49 (Munroe 1961), or, at most, 53 species listed by Collins & Morris (1985). This new increase in species number should come somewhat unexpected, particularly, in a much collected and taxonomically well studied group of papilionid butterflies. Most of the taxa recently recognized as distinct species, however, were already known at the beginning of this century, and only very few represent genuine discoveries (e.g., *Parnassius schultei*, *P. arcticus*, *Luehdorfia longicaudata*). Thus, the majority of recently discovered 'new' species in the Parnassiinae came about by a change of status rather than by the description of new taxa.

This recent increase in species number can probably be explained by a change of general concepts in systematics, which is well reflected by the different attitudes of specialists dealing with the Parnassiinae at different times. In the first half of this century, most authors were primarily concerned with the study of (intraspecific) variation in wing pattern exclusively based on large collections of adult specimens (e.g., Austaut 1899, Verity 1905-1911, Bryk 1934, 1935).

This approach produced an immense number of infraspecific taxa named for the Parnassiinae (Bryk 1922, Eisner 1974, 1976), and it naturally obscured somewhat the question of delimitation of species. In recent times, more and more authors tried to rely for their taxonomic decisions on other morphological, biological and ecological characteristics, many of which usually exhibit larger differences at the species level (e.g., Larsen 1975, Lee 1978, Kreuzberg 1985). This shift away from a purely descriptive taxonomy relying on a single set of adult characters was partly driven by and coincided with the change from a typological towards a biological species concept in systematics (Mayr 1982). In the Parnassiinae, the long applied taxonomic practise to record and name all forms of infraspecific variation in wing pattern still persists today (e.g., Schulte 1992, Weiss 1992), but is slowly giving way to a more biological aproach considering all possible characteristics and pecularities of the group. From this historical perspective it appears therefore understandable that, despite the considerable taxonomic efforts already undertaken in the past, a comparatively high number of unresolved cases at species level in the Parnassiinae remains. The primary purpose of this paper is to direct attention to these cases and encourage further, more detailed studies.

Acknowledgements

Helpful comments and criticisms on a preliminary draft of this paper were received from Dr. W. Eckweiler, Frankfurt/Main, Prof. Dr. C. M. Naumann, Bonn, and Ju. Ju. Stshetkin, Taganrog, Russia. Financial support during the preparation of this paper by the Deutsche Forschungsgemeinschaft is gratefully acknowledged.

References

Ackery, P. R., 1975. A guide to the genera and species of Parnassiinae (Lepidoptera: Papilionidae). – Bulletin of the British Museum (Natural History), Entomology 31 (4): 71-105.

Austaut, J. L., 1889. Les Parnassiens de la faune paléarctique. – E. Heyne, Leipzig, 223 pp.

Avinoff, A., 1916. Some new forms of *Parnassius* (Lepidoptera Rhopalocera). – The Transactions of the Entomological Society of London 1915: 351-360.

Avinov, A., 1913. Quelques formes nouvelles du genre *Parnassius* Latr.. – Horae Societatis Entomologicae Rossicae 40 (5): 1-21 [in Russian].

Bang-Haas, O., 1915. Zur Kenntnis von *Parnassius delphius* Eversm. und verwandter Arten. – Deutsche Entomologische Zeitschrift Iris 29: 148-170.

Bang-Haas, O., 1927. Horae Macrolepidopterologicae regionis palaearcticae. Vol. I. – Verlag Dr. O. Staudinger & A. Bang-Haas, Dresden-Blasewitz, XXVIII + 128 pp. 11 Tafeln.

Bernardi, G., 1970. Note sur la variation géographique d'*Allancastria cerisyi* Godart (Lep. Papilionidae). – Lambillionea 70 (7-8): 55-64.

Blom, W. & C. Eisner, 1979. Parnassiana nova LV. *Allancastria louristana boyrahmadiensis* subsp. nov. – Zoologische Mededelingen 54 (18): 277-278.

Bryk, F., 1922. Baroniidae, Teinoplapidae, Parnassiidae. – In: E. Strand et al. (eds.), Lepidopterorum Catalogus 27: 1-247. – W. Junk, Berlin.

Bryk, F., 1932a. Parnassier der Kelley-Roosevelt Expedition, 1929. – Novitates Zoologicae 37 (2): 381-383.

Bryk, F., 1932b. Parnassiologische Studien aus England. – Parnassiana 2 (1): 1-6.

Bryk, F., 1934. Baroniidae, Teinopalpidae, Parnassiidae pars I. – In: F. E. Schulze et al. (eds.), Das Tierreich 64: XXIII + 129 pp. – W. de Gruyter & Co, Berlin.

Bryk, F., 1935. Parnassiidae pars II (Subfam. Parnassiinae). – In: F. E. Schulze et al. (eds.), Das Tierreich 65: LI + 780 pp. – W. de Gruyter & Co, Berlin.

Bryk, F., 1937. Das Begattungszeichen als Ausdruck phyletischer Beziehungen. – Parnassiana 4 (3-8): 42-45.

Bryk, F., & C. Eisner, 1935. Kritische Revision der Gattung *Parnassius* unter Benutzung des Materials der Kollektion Eisner. (Fortsetzung). – Parnassiana 3 (4-5): 47-62.

Carbonell, F., 1991. Contribution à la connaissance du genre *Archon* Hübner 1822. Découverte de zones de sympatrie pour *Archon apollinus* (Herbst) et *A. apollinaris* Staudinger (Lepidoptera : Papilionidae). – Linneana Belgica 13: 3-12.

Collins, N. M. & M. G. Morris, 1985. Threatened Swallowtail Butterflies of the World. – International Union for Conservation of Nature and Natural Resources, Gland. viii + 402 pp. 8 plates.

Cowan, C. F., 1970. Annotationes Rhopalocerologicae 1970. – Berkhamsted, 70 pp.

Descimon, H., F. Genty & J.-P. Vesco, 1989. L'hybridation naturelle entre *Parnassius apollo* (L.) et *P. phoebus* (F.) dans les Alpes du Sud (Lepidoptera: Papilionidae). – Annales de la Société entomologique de France (N.S.) 25 (2): 109-234, 2 planches.

Eisner, C., 1958. Parnassiana nova XXI. Kritische Revision der Gattungen *Lingamius* und *Koramius.* – Zoologische Mededelingen 36 (6): 83-112.

Eisner, C., 1959a. Parnassiana nova XXIII. Kritische Revision der Gattungen *Lingamius* und *Koramius* (Fortsetzung 2). – Zoologische Mededelingen 36 (9): 143-163.

Eisner, C., 1959b. Parnassiana nova XXV. Kritische Revision der Gattung *Tadumia* (Fortsetzung). – Zoologische Mededelingen 36 (14): 233-246.

Eisner, C., 1961. Parnassiana nova XXX. Nachträgliche Betrachtungen zu der Revision der Subfamilia Parnassiinae (Fortsetzung 3). – Zoologische Mededelingen 37 (11): 167-188.

Eisner, C., 1969. Berichtigung. – Zoologische Mededelingen 43: 176.

Eisner, C., 1974. Parnassiana nova XLIX. Die Arten und Unterarten der Baroniidae, Teinopalpidae und Parnassiidae (Erster Teil) (Lepidoptera). – Zoologische Verhandelingen 135: 1-96.

Eisner, C., 1976. Parnassiana nova XLIX. Die Arten und Unterarten der Baroniidae, Teinopalpidae und Parnassiidae (Lepidoptera) (Zweiter Teil). – Zoologische Verhandelingen 146: 99-266.

Elwes, H. J., 1886. On butterflies of the genus *Parnassius.* –

Proceedings of the Scientific Meetings of the Zoological Society of London 1886: 6-53.

Ferris, C. D., 1976. A proposed revision of non-arctic *Parnassius phoebus* Fabricius in North America (Papilionidae). – Journal of Research on the Lepidoptera 15 (1): 1-22.

Ford, E. B., 1944. Studies on the chemistry of pigments in the Lepidoptera, with reference to their bearing on systematics. 4. The classification of the Papilionidae. – Transactions of the Royal Entomological Society of London 94: 201-223.

Freina, J. J. de, 1979. Zur Kenntnis der Gattung *Allancastria* unter Berücksichtigung der Arten *A. cerisyi* und *A. deyrollei* (Lepidoptera: Papilionidae). – Entomologische Zeitschrift 89 (12): 129-142.

Freina, J. J. de, 1985. Revision der Gattung *Archon* Hübner 1822 mit Angaben zur Biologie, Verbreitung, Morphologie und Systematik von *Archon apollinus* (Herbst 1798) und *Archon apollinaris* Staudinger [1892] 1891 (stat. nov.) (Lepidoptera, Papilionidae). – Nota lepidopterologica 8: 97-128.

Freina, J. J. de, 1986. Bemerkungen zur Biologie, Verbreitung und Systematik kleinasiatischer Papilioniden (Lepidoptera, Papilionidae). – Atalanta 17: 205-208.

Fukuda, H., E. Hama, T. Kuzuya, A. Takahashi, M. Takahashi, B. Tanaka, H. Tanaka, M. Wakahashi & Y. Watanabe, 1982. The life histories of butterflies in Japan. Vol. I. – Hoikusha Publishing Co., Osaka, XII + 277 pp. [in Japanese].

Hancock, D. L., 1983. Classification of the Papilionidae (Lepidoptera): a phylogenetic approach. – Smithersia 2: 1-48.

Häuser, C. L., 1990. Probleme der phylogenetischen Systematik am Beispiel der Parnassiinae (Lepidoptera, Papilionidae). – Verhandlungen der Deutschen Zoologischen Gesellschaft 83: 506.

Häuser, C. L., 1993. Critical comments on the phylogenetic relationships within the family Papilionidae (Lepidoptera). – Nota lepidopterologica 16: 34-43.

Hemming, F., 1934. Revisional notes on certain species of Rhopalocera (Lepidoptera). – Stylops 3: 193-200.

Hemming, F., 1967. The generic names of the butterflies and their type-species (Lepidoptera: Rhopalocera). – Bulletin of the British Museum (Natural History), Entomology, Supplement 9: 1-509.

Hering, M., 1932. Morphologische Untersuchungen in der Gattung *Parnassius* (Lepidopt.) als Beitrag zu einer Kritik am Begriff der Unterart. – Mitteilungen aus dem Zoologischen Museum in Berlin 18: 273-317.

Hering, M., 1935. Über einige geographische Formen von *Parnassius apollo phoebus* F. – Parnassiana 3 (4-5): 45-46.

Hering, M., 1937. Die systematische Bewertung von *Parnassius* (*Tadumia*) *przewalskii* Alph. – Parnassiana 5 (1-3): 8.

Hiura, I., 1980. A phylogeny of the genera of Parnassiinae based on analysis of wing pattern, with description of a new genus (Lepidoptera: Papilionidae). – Bulletin of the Osaka Museum of Natural History 33: 71-95 [in Japanese].

Hou, D., 1992. A new species and three new subspecies on the genus *Bhutanitis*. – Proceedings XIX International Congress of Entomology, Beijing, p. 47.

Huang, R.-X. & S.-I. Murayama, 1991. A new subspecies of *Tadumia przewalskii* from Xinjiang, China (Lepidoptera: Parnassiidae). – Acta Zootaxonomica Sinica 16 (3): 360-362 [in Chinese].

Igarashi, S., 1979. Papilionidae and their early stages. 2 vols. – Tokyo, 218 pp. 357 plates [in Japanese].

Iwamoto, Y. & T. Inomata, 1988. *Parnassius eversmanni* Ménétriés, 1855. – In: A. Ohya & T. Inomata (eds.), Illustrations of selected insects in the world. (A) 3: 33-48 [in Japanese].

Kitahara, H., 1990. Comparison of male genitalia of natural hybrids in sympatric habitat of *Parnassius glacialis* Butler and *P. hoenei* Schweitzer (Lepidoptera, Papilionidae). – Tyo to Ga 41 (2): 45-49 [in Japanese].

Koçak, A. Ö., 1981. Critical check-list of European Papilionoidea (Lepidoptera). – Priamus 1: 46-90.

Koiwaya, S., 1987. A new species of the genus *Parnassius* from Kunlun Mts., China. – Gekkan-Mushi 201: 3-6 [in Japanese].

Korshunov, J. P., 1888. Novye bulavousye tsheshuekrylye (Lepidoptera, Rhopalocera) iz Khakasii, Tuvy i Jakutii. – Novye i Maloizvestiye Vidy Fauny Sibiri 20: 65-80.

Korshunov, J. P., 1990. New genera of the subfamily Parnassiinae Swainson, 1840. – In: G. S. Zolotarenko (ed.), Arthropods and helminths: collected scientific works. – Nauka, Novosibirsk, pp. 99-105 [in Russian].

Kreuzberg, A. V.-A., 1985. Parusniki grupp *delphius*, *charltonius*, *simo* (Lepidoptera, Papilionidae) fauny SSSR. – In: Ministerstvo kultury Uzbekskoj SSR (ed.), Issledovanija flory i fauny srednej Azii. pp. 25-68. Taschkent.

Kreuzberg, A. V.-A., 1987a. Stenophagy in Parnassius (Lepidoptera: Papilionidae) of Central Asia and Altai. – Entomologist's Gazette 38: 95-102.

Kreuzberg, A. V.-A., 1987b. On the ecology of *Parnassius autocrator* (Lepidoptera) - a rare species of papilionids. – Zoologitsheski Journal 66 (7): 1106-1107 [in Russian].

Kreuzberg, A. V.-A. & I. G. Pljushch, 1989. The distribution, ecology and biology of *Parnassius loxias* Püngeler, 1901 (Lepidoptera: Papilionidae). – Entomologist's Gazette 40: 271-280.

Kudrna, O., 1986. Aspects of the conservation of butterflies in Europe. – In: O, Kudrna (ed.), The Butterflies of Europe. Vol. 8. – Aula-Verlag, Wiesbaden, 332 pp.

Kuhna, P., 1977. Über *Allancastria* in Kleinasien. – Atalanta 8: 99-107.

Kurentzov, A. I., 1970. The Butterflies of the Far East USSR. – Izdatelstvo Nauka, Leningrad. 164 pp. [in Russian].

Larsen, T. B., 1973. Two species of *Allancastria* (Insecta; Rhopalocera) in Lebanon. – The Entomologist 106: 45-52.

Larsen, T. B., 1975. Notes on the two species of *Allancastria* Bryk (Lep.: Papilionidae) in Lebanon. – The Entomologist's Record and Journal of Variation 87: 205-208.

Lee, C.-L., 1978. The early stages of Chinese Rhopalocera - *Luehdorfia chinensis* Leech (Parnassiidae: Zerynthiinae). – Acta Entomologica Sinica 21 (2): 161-163 [in Chinese].

Lee, C.-L., 1986a. Ecological and systematic studies of two chineses *Bhutanitis* butterflies I (*Bhutanitis mansfieldi* and *B. thaidina*). – Gekkan-Mushi 187: 1-6 [in Japanese].

Lee, C.-L., 1986b. Ecological and systematic studies of two Chineses *Bhutanitis* Butterflies II *(Bhutanitis mansfieldi* and *B. thaidina*). – Gekkan-Mushi 188: 1-8 [in Japanese].

Mayr, E., 1982. The growth of biological thought. – The Belknap Press of Harvard University Press, Harvard, xiii

+ 974 pp.

Miller, J. S., 1987. Phylogenetic studies in the Papilioninae (Lepidoptera: Papilionidae). – Bulletin of the American Museum of Natural History 186 (4): 365-512.

Moore, F., 1901-1903. Lepidoptera Indica. 5 Rhopalocera; Nymphalidae, Riodinidae, Papilionidae. – London, vii + 248 pp. 85 plates.

Mrácek, Z., 1989. Contribution à la connaissance des Lépidoptères diurnes de la Iakoutie (Lepidoptera Rhopalocera et Hesperiidae). – Linneana Belgica 12: 138-188.

Munroe, E., 1961. The Classification of the Papilionidae (Lepidoptera). – The Canadian Entomologist, Supplement 17: 1-51.

Nardelli, U., 1991. Anmerkungen zur Zucht von *Parnassius*-Arten sowie Bericht über eine Zucht von *Parnassius phoebus sternitzkii* (Lepidoptera: Papilionidae). – Nachrichten des entomologischen Vereins Apollo N.F. 12 (2): 141-152.

Nekrutenko, Yu. P., 1990. The Butterflies of the Caucasus. Part I. – Akademia Nauk Ukrainskoi SSR, Kiev, 215 pp. 32 tabl. [in Russian].

Nekrutenko Yu. P. & I. M. Kerzhner, 1986. On the species and varieties of *Parnassius* (Lepidoptera, Papilionidae) established by E. Ménétriés in the book of J. Siemaschko 'Russkaya Fauna'. – Entomologitsheskoe Obozrenie 65 (4): 769-779 [in Russian].

Nosé, Y. (ed.) 1990. Butterflies and Nature of China. Ressel Company, Osaka, vii + 255 pp. [in Japanese].

Olivier, A., 1991. The taxonomic status of the population of *Zerynthia cerisy* (Godart, [1824]) on the Greek island of Sámos (Lepidoptera : Papilionidae). – Phegea 19: 71-74.

Orr, A. G., 1988. Mate conflict and the evolution of the sphragis in butterflies. – Unpublished Ph.D. - thesis, School of Australian Environmental Studies, Griffith University, Nathan, Queensland, xvi + 348 pp. 39 plates.

Reinig, W. F., 1937. Zur Entstehungsgeschichte der Mannigfaltigkeit und Verbreitung der Parnassier. – Parnassiana 4 (3-8): 45-57.

Reuter, E., 1897. Über die Palpen der Rhopaloceren. Ein Beitrag zur Erkenntnis der verwandtschaftlichen Beziehungen unter den Tagfaltern. – Acta Societatis Scientiarum Fennicae 22: i-xvi, 1-577, Tafel I-VI.

Riley, N. D., 1927. The Rhopalocera of the third Mount Everest expedition (1924). – Transactions of the Entomological Society of London 75: 119-129.

Rothschild, W., 1918a. Catalogue of Zerynthiinae and allied genera in the Tring Museum, with critical notes. – Novitates Zoologicae 25: 64-75.

Rothschild, W., 1918b. Catalogue of Parnassiinae in the Tring Museum. – Novitates Zoologicae 25: 218-262.

Saigusa, T. & C.-L. Lee, 1982. A rare Papilionid butterfly *Bhutanitis mansfieldi* (Riley), its rediscovery, new subspecies and phylogenetic position. – Tyo to Ga 33: 1-24.

Schulte, A., 1992. Beschreibung einiger neuer *Parnassius*-Unterarten aus mehreren China-Ausbeuten 1991 (Lepidoptera, Papilionidae). – Nachrichten des entomologischen Vereins Apollo N.F. 13 (2a): 165-177.

Schweizerischer Bund für Naturschutz (ed.), 1991. Tagfalter und Ihre Lebensräume. 3. Auflage. – Schweizerischer Bund für Naturschutz, Basel, XII + 516 pp.

Scott, J. A., 1986. The Butterflies of North America. – Stanford University Press, Stanford, xvi + 584 pp.

Shinkai, A., 1990. A new subspecies of *Parnassius hide* discovered in Eastern Qinghai, China (Lepidoptera, Papilionidae). – Notes on Eurasian Insects 1: 11.

Sokolov, G. N., 1929. Die Struktur des männlichen Kopulationsapparates bei der Gattung *Parnassius* Latr. – Russkoe Entomologitsheskoe Obozrenie 23: 60-71 [in Russian].

Spuler, A., 1892. Zur Stammesgeschichte der Papilioniden. – Zoologische Jahrbücher, Abtheilung für Systematik, Geographie und Biologie der Thiere 6 (4): 465-495.

Stichel, H., 1907a. Lepidoptera. Fam. Papilionidae, Subfam. Parnassiinae. – In: Wytsman, P. (ed.), Genera Insectorum 58: 1-60 Tafel 1-3.

Stichel, H., 1907b. Lepidoptera. Fam. Papilionidae, Subfam. Zerynthiinae. – In: Wytsman, P. (ed.), Genera Insectorum 59: 1-27 Tafel 1-2.

Stshetkin, Ju. Ju., 1979. The species status of *Parnassius cardinal* Gr.-Gr. and a new subspecies of *Parnassius delphius* Ev. (Lepidoptera: Papilionidae). – Doklady Akademii Nauk Tadzhikskoi SSR 22 (1): 63-66 [in Russian].

Verity, R., 1905-1911. Rhoplaocera Palaearctica. – Florence, LXXXVI + 368 pp. 72 planches.

Watanabe, Y., 1990. A new species of genus *Parnassius* Latreille from Tibet, China (Lepidoptera, Papilionidae). – Notes on Eurasian Insects 1: 2-6.

Weidemann, H.-J., 1986. Tagfalter: Entwicklung - Lebensweise. Band 1. – J. Neumann-Neudamm, Melsungen, 282 pp.

Weiss, J.-C., 1991. The Parnassiinae of the World. Part 1. – Sciences Nat, Venette, 48 pp.

Weiss, J.-C., 1992. The Parnassiinae of the World. Part 2. – Sciences Nat, Venette, pp. 49-135.

Weiss, J.-C. & F. Michel, 1989. Description de nouveaux taxa du genre *Parnassius* provenant du Tibet (Chine) (Lepidoptera Papilionidae). – Bulletin de la Société Sciences Nat 61: 5-19.

Received: September 1993
Accepted: 16 September 1993